An improved glut, method and apparatus for manufacturing gluts.

This invention relates generally to an improved glut and the manufacture of articles of folded or cut and stacked sheet material aligned to form a block, and in particular to methods for manufacturing improved plaster gluts or other articles of folded or cut plasterboard.

Other terms used instead of "glut" are spacer, billet, dunnage, riser or sleuter. Plasterboard in this document also includes drywall sheets, sheetrock, gypsum sheets, gypsum wallboard, gypsum panels and other panel sheeting.

It is known for stacking sheets of plasterboard and almost all other flat sheet panels to use load spacers or plaster gluts that provide required spacing. The load spacers or plaster gluts are formed from new plasterboard or plasterboard remnants which are cut into a standard length, scored along fold lines, and transmitted into a folding apparatus which simultaneously folds and breaks the plasterboard member into two separate members having pleats. The folded members are then compressed and stapled to form the completed plaster gluts. Such plaster gluts are used as spacers or risers beneath stacks of sheet material, such as gypsum board, for shipping (transporting) purposes or for storage. The plaster gluts enable the insertion of the forks of forklift vehicle or apparatus beneath the stack of sheet material for movement thereof and can be used as spacers between stacks sorted into different sized stacks.

Plaster gluts of folded plaster have the advantage that they do not discolour or physically mark the surface of the stacked sheet plasterboard or other sheet material stacked thereon, and therefore have an advantage over conventional spacers of wood in this regard. Furthermore, wood of sufficient strength is generally too heavy. Strong light weight wood is generally slow growing and is particularly expensive. It is therefore difficult to locate material which is readily available, usable as a lightweight but compressible strong material, commercially possible and that does not affect the plasterboard.

In addition, the method of the present invention enables plasterboard remnants to be made into commercial articles that solve usage problems taking into account the stricter requirements of occupational health and safety precautions of the modern workforce.

In accordance with the invention there is provided a method for manufacturing "plaster gluts" or other articles of folded plasterboard and a novel plaster glut or article of stacked laminates.

In accordance with the invention there is provided plaster gluts which can be employed as spacers or risers between stacks of plasterboard or other sheet material and have the advantage that they do not physically mark or discolour such plasterboard, as conventional wooden spacers sometimes do. The gluts formed from a stack of panel members or a concertina of panel members, the panels having one or more cut-outs to decrease weight.

The invention also provides a method of manufacturing plaster gluts formed from plasterboard sheet, which could be remnants, by cutting the sheet to a pre-determined standard length, scoring or partially guillotining in parallel lines on opposing sides of the sheet to provide fold lines, making cut-outs within the parallel fold lines to decrease weight and folding into concertina folded panel members to form a useable glut able to space sheets of plasterboard sufficiently to allow fork lifts to be used.

Preferably the outer panels are not subject to cut-outs such that the plaster glut has the appearance of a solid block but includes internal cavities.

However the outer panels can have holes all the way through as well such that the plaster glut has the appearance of a "Swiss cheese" block with internal cavities.

To provide strength as a support structure, each panel in a stack of panels or concertina of panels forming a plaster glut has adjacent, at least partially aligned, support portions to form a continuous post structure extending linearly from top panel to bottom panel.

The cavities are located to retain substantial strength of the glut. The cut-outs of adjacent panels can align when folded together so as to form continuous cavities with continuous support posts of cross members and outside or circumferential members to retain strength.

The support posts could be formed by central cut-outs leaving a circumferential structure of each panel to form a circumferential support post, and can be the lightest of the proposed gluts. The support structure could also include cross members extending from one circumferential side to the other of each panel and overlapping at least partially from panel to panel when stacked adjacently or in concertina form to form continuous cross member support posts from top panel to bottom panel.

The support posts preferably extend linearly over the shortest path from top panel to bottom panel to form strong support structure. However the support posts can extend linearly but at an angle from top panel to bottom panel.

Also the support posts could extend from a side of the stack to the opposing side rather than top panel to bottom panel as long as, in use, the continuous linear support posts are in line with direction of required support.

The concertina folded plasterboard gluts or stacked separate panels can be aligned and the layers shrink-wrapped together to form the completed plaster glut.

The plasterboard sheet remnants can be cut to distinct separate panels of a standard width and length, and cut-outs can be made within the confines of the panels and spaced from the circumferential edge to decrease weight, and the distinct separate panels can be transmitted through a guide to align them while their layers are shrink wrapped together to form the completed plaster glut able to space sheets of plasterboard sufficiently.

The shrink wrapping of the glut is preferred but it can be replaced by other suitable means such as poly-strapping. However, the shrink wrapping of the glut serves

several useful purposes. It fastens the layers of the glut together (as does the poly-strapping), it maintains the integrity of the glut (by reducing chipping, crushing, etc. and enclosing any chipped or crushed gypsum which might occur) and also has a substantial advantage in providing enhanced friction to the surface of the glut which aids the function of the glut in the transport of plasterboard.

Preferably the outer panels are not subject to cut-outs such that the plaster glut has the appearance of a solid block but includes internal cavities. The cut-outs of adjacent panels can align when placed in a stack so as to form continuous cavities with continuous cross members and outside members with each forming support posts to retain strength.

The cavities can be formed by one or more sized cut-outs in each panel. The cut-outs can be aligned and undertaken in one action when the panels are stacked or concertina folded. However each panel can be separately cut-out before stacking or concertina folding of the panels.

The cavities can be formed in another aspect by cut-outs from end or from the sides of the stacked panels or concertina folded plasterboard.

Cut-outs can be formed by drilling circular cut-outs or stamping cut-outs of various shapes.

However in another form the cut-outs can be made by linear cuts from a circular saw or the like.

The cut-outs can remove over 50% of the mass of at least the panels between the top and bottom panels. However the top and bottom panels can also include cut-outs. Overall the weight can be reduced by over 50%. For example, the plaster glut previously made in the prior art was about 7.5 kilograms. The improved plaster glut can be of the order of 3.5 kilograms to 4.2 kilograms while substantially maintaining the strength of the initial article.

It can be seen the present invention provides an improved glut of folding sheet material which operates in a simple, trouble-free manner.

An additional aspect of the invention is to provide a plaster glut manufacturing machine which employs the above-mentioned folding apparatus and stamping process.

Still another aspect of the present invention is to provide a machine that automatically cuts the sheet material into members of standard lengths. Then scores or partially cuts or guillotines the upper and lower surfaces of such members along fold lines before transmitting them to the folding apparatus.

In one form a concertina folded plaster glut can be created in a stamping process where a series of parallel guillotine blades on the underneath of a sheet of plaster board and a series of parallel guillotine blades above the sheet of plaster board can be similarly spaced but aligned offset such that in a cutting mechanism they move relatively towards each other to form fold lines. Preferably those cut fold lines extend the entire width but only partially through the depth of the plasterboard so that one outer surface remains connected to allow concertina folding of panels into plaster glut.

The stamping process can also include cut-out blades to make the cut-outs of each panel between the guillotined cut lines.

In one form the cut-out blades can be a series of male and female blades shaped respectively to allow interfitting engagement and clean cutting of the cut-outs.

Alternatively the guillotining action can penetrate entirely through the plasterboard to form a series of separate panels for stacking into one plaster glut.

A still further aspect of the invention is to provide such a machine which automatically fastens the folded plasterboard members together by shrink wrapping to form the completed plaster gluts.

Another aspect of the invention is to provide such a machine which stacks the completed plaster gluts in rows.

In order that the invention is more readily understood various embodiments of the invention will be described by way of illustration only with reference to the drawings wherein:

FIGURE. 1 is a perspective view of a plaster glut in accordance with a first embodiment of the invention;

FIGURE. 2 is a perspective view of the plaster glut of Figure 1 with top panel opened;

FIGURE. 3 is perspective view of a plaster glut in accordance with a second embodiment of the invention; the glut is drilled as a whole after folding through top and bottom panels.

FIGURE. 4 is perspective view of a plaster glut in accordance with a third embodiment of the invention; circumferential support.

FIGURE. 5 is perspective view of a plaster glut in accordance with a fourth embodiment of the invention; different size holes are displayed for the sole purpose of showing possibility of different size and shape.

FIGURE. 6 is perspective view of a plaster glut in accordance with a fifth embodiment of the invention; show that holes can be drilled into side of glut

FIGURE. 7 is perspective view of a plaster glut in accordance with a sixth embodiment of the invention; showing holes drilled into end of glut.

FIGURE. 8 is perspective view of a plaster glut in accordance with a seventh embodiment of the invention; diagonal hole give almost the same support but supply more weight reduction.

FIGURE. 9 is perspective view of a plaster glut in accordance with a eighth embodiment of the invention; shows a stamp cut-out to show the different shapes or logos which can be used.

FIGURE. 10 is perspective view of a plaster glut in accordance with a ninth embodiment of the invention; show a straight line cut from edge of the glut this is what a circular saw or guillotine may provide.

FIGURE. 11 is perspective view of a plaster glut in accordance with a tenth embodiment of the invention; showing that the cuts don't have to be centred.

FIGURE. 12 is a process line layout of the general machine sub-assemblies to

manufacture the gluts of the invention.

FIGURE. 13 is a perspective view of the press assembly of FIGURE. 12.

FIGURE. 14 is a plan view of a die suitable for use in the press of FIGURE 13.

Referring to the drawings, and in particular to Figures 1 and 2, plaster gluts 11 are formed from plasterboard sheet which could be remnants by cutting to a standard length, and partial guillotining or scoring in parallel lines 15 on opposing sides of the sheet to provide fold lines. The scored or partially guillotined sheet is folded into concertina folded rectangular panels 13, 14 and 19 to form a useable block like glut 11 able to space sheets of plasterboard or other sheeting sufficiently to allow fork lifts to be used.

Cut-outs 21 are made within the parallel fold lines to decrease weight by over 50%. In Figures 1, 2, 3, 5 and 11 the cavities are formed by drilling or stamping circular cut-outs of various sizes from above. In the case of Figure 1 the cut-outs do not include top and bottom panels 12, 19. In Figure 11 the cavity is formed by only part of the circular cut-out drill or stamping mechanism.

The cavity in Figure 9 is formed by a stamping of a star shape cut-out means. Clearly any required shaped can be cut out. Cut-outs can be formed by drilling circular cut-outs or stamping cut-outs of various shapes. Figure 9 displays this with the use of a star shape but any shape will do even a company logo.

The cutting process can occur prior to the sheet being folded. In another form the cut-out occurs after concertina folding of panels 12 to 19.

As shown in Figures 1 and 2 the outer panels 12 and 19 are not subject to cut-outs such that the plaster glut 11 has the appearance of a solid block but includes internal cavities 21.

The plaster glut is created in a stamping process where a series of parallel guillotine blades on the underneath of a sheet of plaster board and a series of parallel guillotine blades above the sheet of plaster board can be similarly spaced but aligned offset such

that in a cutting mechanism they move relatively towards each other to form fold lines. Those cut lines extend the entire width but only partially through the depth of the plasterboard so that one outer surface remains connected to allow concertina folding of panels into plaster glut. The stamping process includes cut-out blades to make the cut-outs of each panel between the guillotined cut lines. The cut-out blades are a series of male and female blades shaped respectively to allow interfitting engagement and clean cutting of the cut-outs. The concertina folded plasterboard gluts are aligned and layers shrink-wrapped together to form the completed plaster glut.

To provide strength as a support structure each panel in a stack of panels or concertina of panels forming a plaster glut has adjacent at least partially aligned support portions to form a continuous post structure extending linearly from top panel 12 to bottom panel 13. The cavities 21 are located to retain substantial strength of the glut. The cut-outs 21 of adjacent panels 13 and 14 align when folded together so as to form continuous cavities with continuous cross members 32 and outside circumferential support members 31 to retain strength.

As shown particularly in Figure 4, the support posts can, in one aspect, be formed by central cut-outs 22 leaving only a circumferential structure 31 of each panel to form a circumferential support post. This is the lightest of the proposed gluts.

The support structure also includes primarily cross members 32 extending from one circumferential side to the other of each panel and overlapping at least partially from panel to panel when stacked adjacently or in concertina form to form continuous cross member support posts from top panel 12 to bottom panel 19. Clearly in the form where top and bottom panels 12 and 19 are not subject to cut-outs any portion of the top and bottom panels will be adjacent support members 21 or 22 of the intermediate panels 13, 14 ... having cut-outs.

Shown particularly Figure 1, the support posts 31, 32 extend linearly over the shortest path from top panel 12 to bottom panel 19 to form strong support structure. However as shown in Figure 8 the support posts 32 can extend linearly but at an angle from top

panel 12 to bottom panel 19.

The cavities can be formed in another embodiment, as shown in Figures 6 and 7, by cut-outs from a longitudinal end or from the sides of the stacked panels or concertina folded plasterboard.

In a further form the cut-outs can be made by linear cuts from a circular saw or the like. Figure 10 displays this as it has straight line cuts from the end of the glut.

The cut-outs can remove over 50% of the mass of at least the panels between the top and bottom panels. However, the top and bottom panels can also include cut-outs. Overall the weight can be reduced by over 50%. For example, the plaster glut previously made was about 7.5 kilograms. The improved plaster glut can be of the order of 3.5 kilograms to 4.2 kilograms while substantially maintaining initial strength.

The process line layout of the general machine sub-assemblies to manufacture the gluts of the invention is shown in Figure 12. The general machine sub-assemblies include:

- 1.0 Sheet Infeed System
- 2.0 Guillotine Cutting
- 3.0 Slice and Perforate system
- 4.0 Press Infeed & Hole Cutting
- 5.0 Concertinaing
- 6.0 Shrink Wrapping
- 7.0 Palletising

1.0 Sheet Infeed System

The sheet feeding system consists of an area where forklift trucks position a stack of plasterboard onto a steel constructed platform where it is squared up to datum posts, this ensures that stacks are parallel to the infeed line. This system is fitted with sensors to automatically detect stack length for machine product size change.

The steel platform then raises the stack of plasterboard to a given height for pickup by a pneumatically operated device, which is fitted with 6 to 8 suction cups. This device then applies vacuum to the cups and holds the top board whilst the platform lowers to a given height.

The suction cup frame then indexes sideways to feed the end of the sheet into a set of pinch rollers; these then take over the rest of the sheet indexing for the guillotining process. The suction cup frame then returns to home position to await the next plasterboard sheet to arrive at pickup position via the pre mentioned platform.

2.0 Guillotine Cutting

The guillotine has a top and bottom (toothed blade) where the plasterboard is fed between for cutting via the pre mentioned pinch rollers, the blades move together in a vertical direction to shear the plasterboard to length. On the outfeed side of the guillotine is a pneumatic stopper device to accurately position the plasterboard for cutting to length, this length is determined by an operator selecting the plasterboard thickness via a control panel. In addition to cutting the plasterboard sheets to become a pack spacer, there is an automatic program setting to cut the sheet off cut into approximately 100mm wide strips to become transport packers or simply go to a crusher for re-cycling.

3.0 Slice and Perforate System

After the board has been cut to length it then is transported to a set of pinch rollers, these rollers grip the board and force it through a set of 8 rotary cutting and perforating discs. These discs have a cutting edge to penetrate the paper covering of the plasterboard; this slices one side of the board and perforates the other side of the board to create nine hinged sections along the length of the board, ready for the concertinaing process.

4.0 Press Infeed & Hole Cutting

After the slice and perforate process happens the board is conveyed to a mechanical stop which positions the board on centerline to the press, then a pneumatic pushing device pushes the board to a wait station and then returns to home position, after the

next board has passed through the slice and perforate system and arrives at the mechanical stop the pushing device pushes the newly arrived board onto the board at wait station, forcing the waiting board into the press and in turn ends up at the wait station itself. The board which has now been pushed inside the press is hole-punched by a set of blades top and bottom of the press platens, these discs of plasterboard cut by the blades fall into a hopper for collection and are transported to a crusher for re-cycling. The now hole-punched board waits inside the press until another board has come through the slice and perforate system and is then pushed to wait station thus causing the hole-punched board to exit the press and the board at wait station has now been positioned inside the press, then the process repeats.

5.0 Concertinaing

After the hole punched board exits the press it is pushed onto a waiting conveyor, which feeds the board into a concertinaing machine. This machine consists of concertinaing blades and pneumatic devices to take the flat board that has been sliced / perforated and hole punched to form it into a partially folded up block of plasterboard slats. The partially folded slats are then conveyed along the conveyor to a pneumatically driven roll over device which picks up and rolls the slats over 90° to resemble a white piece of wood, this is now be called a "Pack Spacer". The pack spacer is then conveyed to the infeed side of a shrink-wrapping machine.

6.0 Shrink Wrapping

After the concertinaing and roll over process, the pack spacer is fed into a shrink-wrapping machine; this machine consists of pneumatic and electric devices to enable the pack spacer to be fully wrapped in a plastic film. The now wrapped pack spacer is conveyed to a heat tunnel where the plastic film is shrunk tightly to the out side of the pack spacer to help with the integrity and to protect it from the elements plus keep the particles of gyprock from falling off the pack spacer.

7.0 Palletising

Following the shrink-wrapping process the pack spacer is conveyed from the shrink tunnel to an end stopping position, this end stop is automatically size changed via an operator control panel, the pack spacer then triggers a switch mounted on the stopper

bar to activate a pusher cylinder, and this cylinder indexes the pack spacer to an accumulation table. This process repeats until the desired number of pack spacers has been accumulated to form a full layer. At this point the machine program instructs the palletiser to pick up the waiting full layer and transport it via a vertical and horizontal moving gripper head to a floor or conveyor mounted pallet at one of two loading cells, this process is repeated with the exception of the full layer being rotated 90° to the previous layer then lowered onto the top of the last full layer. This palletising process repeats (alternating orientation) until the desired number of layers has been reached. After a pallet is deemed full the machine guarding closes off and isolates the particular loading cell which is full, this is to protect personnel from machine parts whilst this pallet is indexed out of the cell and into storage; the full pallet is replaced with an empty pallet ready for loading. Until the transfer of the full and empty pallet is complete, the palletiser changes loading to the alternate cell to keep up with the production of pack spacers.

It can be seen the present invention provides an improved light-weight glut of folded or stacked sheet material which operates in a simple, trouble-free manner.

It will be obvious to those having ordinary skill in the art that many changes can be made in the details of the preferred embodiment of the invention without departing from the spirit of the invention. Therefore, the scope of the invention should be understood to include such variations.

In this specification the words "includes", "including" and the like and "comprises", "comprising" and the like should be considered synonymous and be given a non-exhaustive meaning; thus, they are not intended to exclude other additives, components, integers or steps.